CONTROL CONCEPTS

ETHERNET/IP

USER'S MANUAL

FUSION SCR POWER CONTROLLERS

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WARNING: The Control Concepts, Inc. power controllers use power thyristors to switch voltage to the connected load. Line voltage must be assumed at the output terminals at all times, even when the control signal has been removed and the load voltage appears to be off. It has been mandated by the National Electrical Code and the Occupational Safety and Heath Act of 1970 that a physical disconnect be opened ahead of all remotely actuated controls before performing any maintenance work on the controller or its connected load.

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1. OVERVIEW

In general, FUSION parameters are all 16 bit integer values. However, there are some parameters such as Load Power Zone 1 which use two registers for the value (32 bit value.) These long word situations are clearly documented with HI and LO word parameters.

Some values may have digits to the right of the decimal point. The decimal point, or resolution, will not be part of the message. Rather a parameter with one decimal place will be scaled x10, two decimal places scaled x100.

Example: 5.00 must be scaled and sent as 500 and will also need to be scaled when read using a "scale-factor" of 100.

The first two bytes of PLC memory are status bytes and are not used.

Current sampling rate is 5 Hz.

Ethernet/IP is Little Endian by specification. The least significant byte will appear first

The Digital Setpoints and Digital System Command are the only parameters that can be set via the PLC at this time.

Input data read with Read Assembly command Class 0x04, Instance 0x65, Attribute 0x03.

Output data written with Write Assembly command Class 0x04, Instance 0x66, Attribute 0x03.

The configuration assembly object is not implemented. If required, use Instance ID 0x80 with a data length of 0x00.

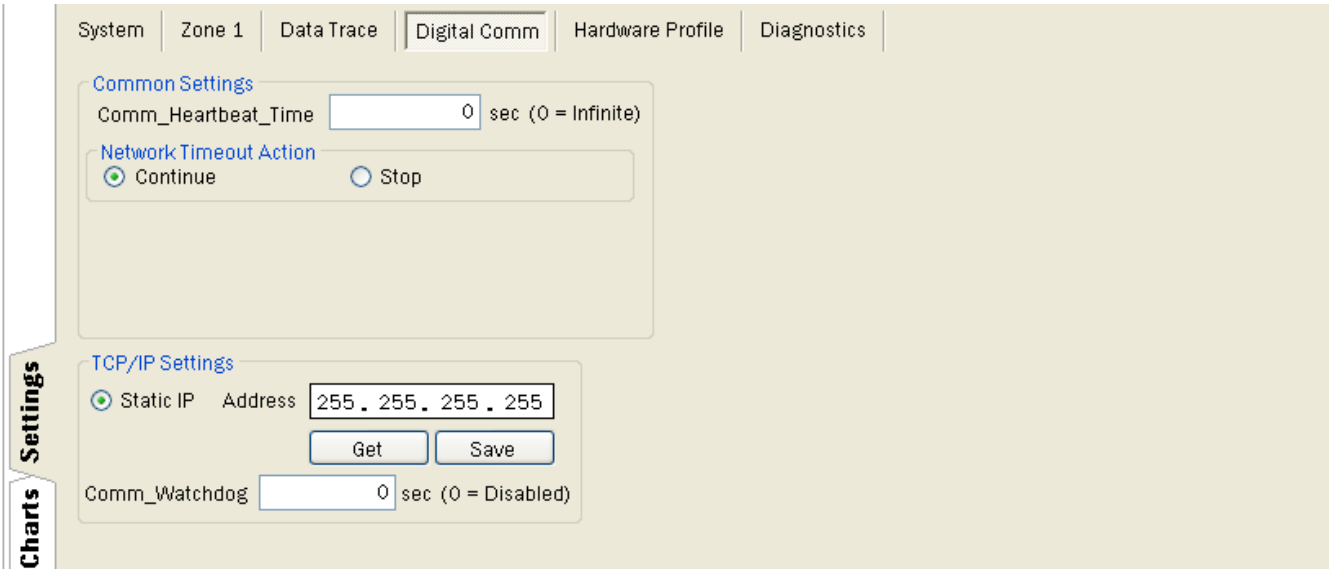
2. FUSION Ethernet/IP TCP Wiring (-I Digital Communications Option)

Ethernet 10BaseT (Twisted Pair)		
Pin #	**Signal Name**	**Function**
1	TD+	Transmit Data
2	TD-	Transmit Data
3	RD+	Receive Data
4	NC	No Connection
5	NC	No Connection
6	RD-	Receive Data
7	NC	No Connection
8	NC	No Connection

FUSION with Ethernet/IP uses a standard Ethernet pin-out shown above. We recommend using at least Cat 5e shielded cable between the controller and other Ethernet-enabled devices.

3. FUSION CONNECTION SETTINGS

Use the FUSION Control Panel Software and USB connection to set up the Ethernet IP settings for the power controller. After a connection is made, select the “Digital Comm” tab as shown below.



3.1 Common Settings

The “Comm Heartbeat Time” is a digital watchdog that puts the FUSION Power Controller in safe mode whenever there has been no digital communications for at least N seconds. The timer is re-set every time a digital communication is made with the controller. The default value is zero, which corresponds to an infinite timeout.

The “Network Timeout Action” is the action the controller will take when a timeout occurs. The two options are continuing at the last-known set point, or stopping output. The default is “Continue.”

3.2 TCP/IP Settings

STATIC IP addressing is set by selecting the STATIC IP radio button. The IP address is entered into the form and sent to the FUSION controller by the SAVE button.

The “comm_watchdog” is a digital watchdog that detects an absence of Ethernet communications lasting N seconds, and then checks the IP address stored in the Ethernet-based module. If the module IP address does not match the addresses stored in eeprom, the module is reprogrammed with the correct address.

The range in seconds is 15 to 65535. The default value is zero, which corresponds to an infinite timeout.

PARAMETER LIST

Input/Output Range: Offset 0 to 9

Integer 0 **Output Enable**
Units: N/A
Minimum: 0.00
Maximum: 1.00
LSB: 0
Output Enable: 1
Read-Only: 0

Integer 1 **Digital Setpoint 1**
Units: % of Full Scale
Minimum: 0.00
Maximum: 100.00
Default: 0.00

Integer 2 **Digital Setpoint 2**
Units: % of Full Scale
Minimum: 0.00
Maximum: 100.00
Default: 0.00

Integer 3 **Digital Setpoint 3**
Units: % of Full Scale
Minimum: 0.00
Maximum: 100.00
Default: 0.00

Integer 4 **Digital Setpoint 4**
Units: % of Full Scale
Minimum: 0.00
Maximum: 100.00
Default: 0.00

Integer 5 **Digital Setpoint 5**
Units: % of Full Scale
Minimum: 0.00
Maximum: 100.00
Default: 0.00

Integer 6 **Digital Setpoint 6**
Units: % of Full Scale
Minimum: 0.00
Maximum: 100.00
Default: 0.00

Integer 7 **Digital Setpoint 7**
Units: % of Full Scale
Minimum: 0.00
Maximum: 100.00
Default: 0.00

Integer 8 **Digital Setpoint 8**
Units: % of Full Scale
Minimum: 0.00
Maximum: 100.00
Default: 0.00

Integer 9 **Digital System Command**
Units: N/A
Minimum: 00000000 = 0
Maximum: 11111111 = 255
Representation:

	Bit		
MSB	7	=	not used
	6	=	not used
	5	=	not used
	4	=	not used
	3	=	Zone 4, Run=1/Stop=0
	2	=	Zone 3, Run=1/Stop=0
	1	=	Zone 2, Run=1/Stop=0
LSB	0	=	Zone 1, Run=1/Stop=0

Parameters – Input Range: Offset 10 - 80

Integer 10 **Line Frequency**
Units: Hz
Minimum: 0.0
Maximum: 99.9

Integer 12 **Line Voltage A**
Units: RMS Volts
Minimum: 0.0
Maximum: 999.9

Integer 12 **Load Voltage A**
Units: Vcolts RMS or Average
Minimum: 0.0
Maximum: 999.9

Integer 13 **Load Current A**
Units: Amps RMS or Average
Minimum: 0.0
Maximum: 9999.9

Integer 14 **Load Resistance A (Not Active)**
Units: Ohm
Minimum: 0.0
Maximum: 9999.9

Integer 15 **Heatsink temp A (Not Active for Compact FUSION)**
Units: Degrees C
Minimum: 0.0
Maximum: 999.9

Integer 16 **Line Voltage B**
Units: RMS Volts
Minimum: 0.0
Maximum: 999.9

Integer 17 **Load Voltage B**
Units: Volts RMS or Average
Minimum: 0.0
Maximum: 999.9

Integer 18 **Load Current B**
Units: Amps RMS or Average
Minimum: 0.0
Maximum: 9999.9

Integer 19 **Load Resistance B (Not Active)**
Units: Ohm
Minimum: 0.0
Maximum: 9999.9

Integer 20 **Heatsink temp B**
Units: Degrees C
Minimum: 0.0
Maximum: 999.9

Integer 21 **Line Voltage C**
Units: RMS Volts
Minimum: 0.0
Maximum: 999.9

Integer 22 **Load Voltage C**
Units: Volts RMS or Average
Minimum: 0.0
Maximum: 999.9

Integer 23 **Load Current C**
Units: Amps RMS or Average
Minimum: 0.0
Maximum: 9999.9

Integer 24 **Load Resistance C (Not Active)**
Units: Ohm
Minimum: 0.0
Maximum: 9999.9

Integer 25 **Heatsink temp C (Not Active for Compact FUSION)**
Units: Degrees C
Minimum: 0.0
Maximum: 999.9

Integer 26 **Line Voltage D**
Units: RMS Volts
Minimum: 0.0
Maximum: 999.9

Integer 27 **Load Voltage D**
Units: Volts RMS or Average
Minimum: 0.0
Maximum: 999.9

Integer 28 **Load Current D**
Units: Amps RMS or Average
Minimum: 0.0
Maximum: 9999.9

Integer 29 **Load Resistance D (Not Active)**
Units: Ohm
Minimum: 0.0
Maximum: 9999.9

Integer 30 Heatsink temp D
Units: Degrees C
Minimum: 0.0
Maximum: 999.9

Integer 31 Load Power Zone 1 HI (MSW)
Units: Watts or VA
Minimum: -99
Maximum: 99

Integer 32 Load Power Zone 1 LO (LSW)
Units: Watts or VA
Minimum: 0
Maximum: 65535

Integer 33 Power Factor Zone 1
Units: N/A
Minimum: 0.00
Maximum: 9.99

Integer 34 Controller State Zone 1
Units: N/A
Minimum: 0
Maximum: 2
Representation:
0 = STOP
1 = RUN
2 = FAULT

Integer 35 Output% Zone 1
Units: % ON
Minimum: 0.0
Maximum: 999.9

Integer 36 Output Command Zone 1 HI (MSW)
Units: V, A, W
Minimum: -99
Maximum: 99

Integer 37 Output Command Zone 1 LO (LSW)
Units: V, A, W
Minimum: 0
Maximum: 65535

Integer 38 Feedback Zone 1 HI (MSW)
Units: V, A, W
Minimum: -99
Maximum: 99

Integer 39 Feedback Zone 1 LO (LSW)
Units: V, A, W
Minimum: 0
Maximum: 65535

Integer 40 Control Loop Error Zone 1 HI (MSW)
Units: V, A, W
Minimum: -99
Maximum: 99

Integer 41 Control Loop Error Zone 1 LO (LSW)
Units: V, A, W
Minimum: 0
Maximum: 65535

Integer 42 Warning Alarm Zone 1
Units: N/A
Minimum: 00000000 = 0
Maximum: 11111111 = 255

	Bit		
MSB	7	=	not used
	6	=	not used
	5	=	Load Imbalance (Not Active)
	4	=	Shorted SCR
	3	=	Heatsink Temp
	2	=	Power Limit
	1	=	Current Limit
LSB	0	=	Voltage Limit

Integer 43 Load Power Zone 2 HI (MSW)
Units: Watts or VA
Minimum: -99
Maximum: 99

Integer 44 Load Power Zone 2 LO (LSW)
Units: Watts or VA
Minimum: 0
Maximum: 65535

Integer 45 Power Factor Zone 2
Units: N/A
Minimum: 0.00
Maximum: 9.99

Integer 46 Controller State Zone 2
Units: N/A
Minimum: 0
Maximum: 2
Representation:
0 = STOP
1 = RUN
2 = FAULT

Integer 47 Output% Zone 2
Units: % ON
Minimum: 0.0
Maximum: 999.9

Integer 48 Output Command Zone 2 HI (MSW)
Units: V, A, W
Minimum: -99
Maximum: 99

Integer 49 Output Command Zone 2 LO (LSW)
Units: V, A, W
Minimum: 0
Maximum: 65535

Integer 50 Feedback Zone 2 HI (MSW)
Units: V, A, W
Minimum: -99
Maximum: 99

Integer 51 Feedback Zone 2 LO (LSW)
Units: V, A, W
Minimum: 0
Maximum: 65535

Integer 52 Control Loop Error Zone 2 HI (MSW)
Units: V, A, W
Minimum: -99
Maximum: 99

Integer 53 Control Loop Error Zone 2 LO (LSW)
Units: V, A, W
Minimum: 0
Maximum: 65535

Integer 54 Warning Alarm Zone 2
Units: N/A
Minimum: 00000000 = 0
Maximum: 11111111 = 255
Representation:

	Bit		
MSB	7	=	not used
	6	=	not used
	5	=	Load Imbalance (Not Active)
	4	=	Shorted SCR
	3	=	Heatsink Temp
	2	=	Power Limit
	1	=	Current Limit
LSB	0	=	Voltage Limit

Integer 55 Load Power Zone 3 HI (MSW)
Units: Watts or VA
Minimum: -99
Maximum: 99

Integer 56 Load Power Zone 3 LO (LSW)
Units: Watts or VA
Minimum: 0
Maximum: 65535

Integer 57 Power Factor Zone 3
Units: N/A
Minimum: 0.00
Maximum: 9.99

Integer 58 Controller State Zone 3
Units: N/A
Minimum: 0
Maximum: 2
Representation:
0 = STOP
1 = RUN
2 = FAULT

Integer 59 Output% Zone 3
Units: % ON
Minimum: 0.0
Maximum: 999.9

Integer 60 **Output Command Zone 3 HI (MSW)**
Units: V, A, W
Minimum: -99
Maximum: 99

Integer 61 **Output Command Zone 3 LO (LSW)**
Units: V, A, W
Minimum: 0
Maximum: 65535

Integer 62 **Feedback Zone 3 HI (MSW)**
Units: V, A, W
Minimum: -99
Maximum: 99

Integer 63 **Feedback Zone 3 LO (LSW)**
Units: V, A, W
Minimum: 0
Maximum: 65535

Integer 64 **Control Loop Error Zone 3 HI (MSW)**
Units: V, A, W
Minimum: -99
Maximum: 99

Integer 65 **Control Loop Error Zone 3 LO (LSW)**
Units: V, A, W
Minimum: 0
Maximum: 65535

Integer 66 **Warning Alarm Zone 3**
Units: N/A
Minimum: 00000000 = 0
Maximum: 11111111 = 255
Representation:

	Bit		
MSB	7	=	not used
	6	=	not used
	5	=	Load Imbalance (Not Active)
	4	=	Shorted SCR
	3	=	Heatsink Temp
	2	=	Power Limit
	1	=	Current Limit
LSB	0	=	Voltage Limit

Integer 67 **Load Power Zone 4 HI (MSW)**
Units: Watts or VA
Minimum: -99
Maximum: 99

Integer 68 **Load Power Zone 4 LO (LSW)**
Units: Watts or VA
Minimum: 0
Maximum: 65535

Integer 69 **Power Factor Zone 4**
Units: N/A
Minimum: 0.00
Maximum: 9.99

Integer 70 **Controller State Zone 4**
Units: N/A
Minimum: 0
Maximum: 2
Representation:

0	=	STOP
1	=	RUN
2	=	FAULT

Integer 71 **Output% Zone 4**
Units: % ON
Minimum: 0.0
Maximum: 999.9

Integer 72 **Output Command Zone 4 HI (MSW)**
Units: V, A, W
Minimum: -99
Maximum: 99

Integer 73 **Output Command Zone 4 LO (LSW)**
Units: V, A, W
Minimum: 0
Maximum: 65535

Integer 74 **Feedback Zone 4 HI (MSW)**
Units: V, A, W
Minimum: -99
Maximum: 99

Integer 75 **Feedback Zone 4 LO (LSW)**
Units: V, A, W
Minimum: 0
Maximum: 65535

Integer 76 **Control Loop Error Zone 4 HI (MSW)**
Units: V, A, W
Minimum: -99
Maximum: 99

Integer 77 **Control Loop Error Zone 4 LO (LSW)**
Units: V, A, W
Minimum: 0
Maximum: 65535

Integer 78 **Warning Alarm Zone 4**
Units: N/A
Minimum: 00000000 = 0
Maximum: 11111111 = 255
Representation:

	Bit		
MSB	7	=	not used
	6	=	not used
	5	=	Load Imbalance (Not Active)
	4	=	Shorted SCR
	3	=	Heatsink Temp
	2	=	Power Limit
	1	=	Current Limit
LSB	0	=	Voltage Limit

Integer 79 **Model - Config Data**
Units: CODED
Minimum: 0000
Maximum: FFFF
Default: 0000

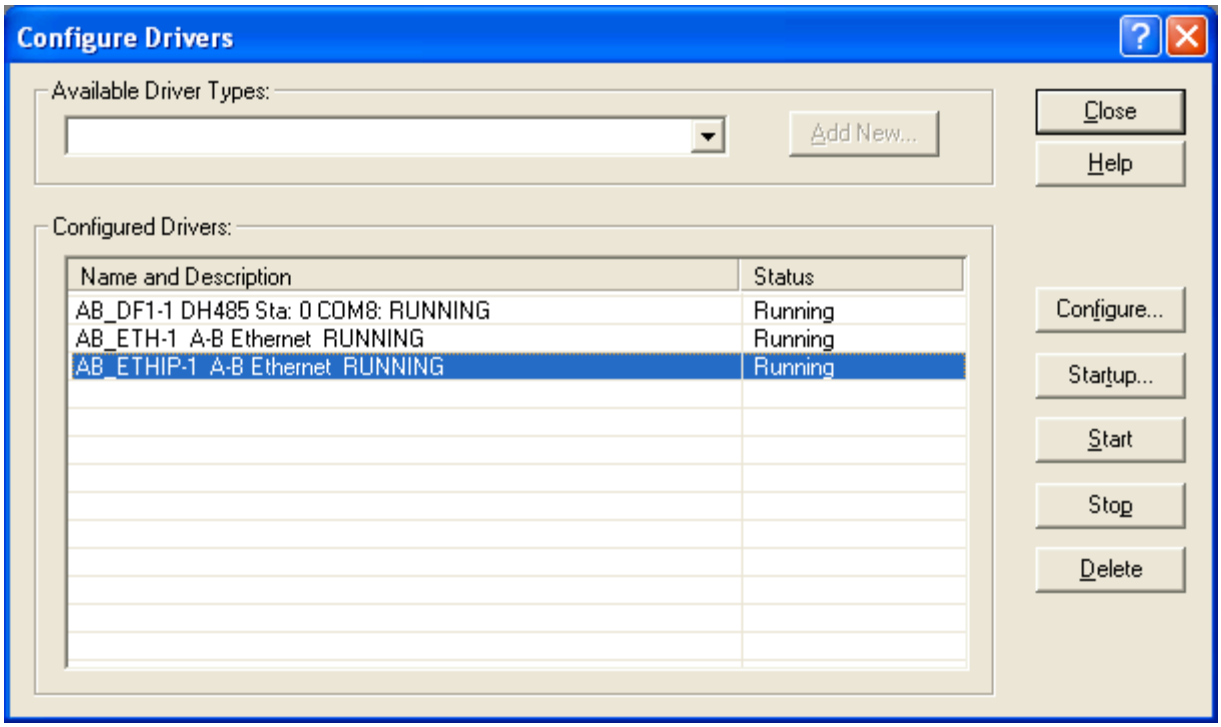
Integer 80 **Inhibit Alarm Status**
Units: N/A
Minimum: 00000000 = 0
Maximum: 11111111 = 255
Representation:

	Bit		
MSB	7	=	Watchdog Timeout
	6	=	Memory Error
	5	=	not used
	4	=	not used
	3	=	Line Phase Loss
	2	=	PLL Lock Loss
	1	=	Heatsink Over-Temp
LSB	0	=	Current Trip

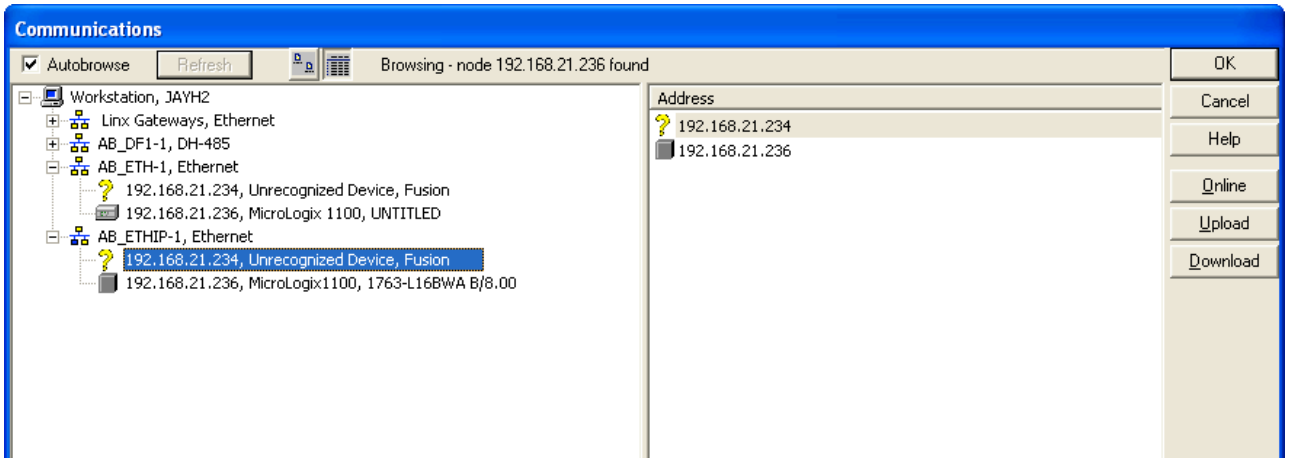
4. Configuring FUSION Ethernet/IP

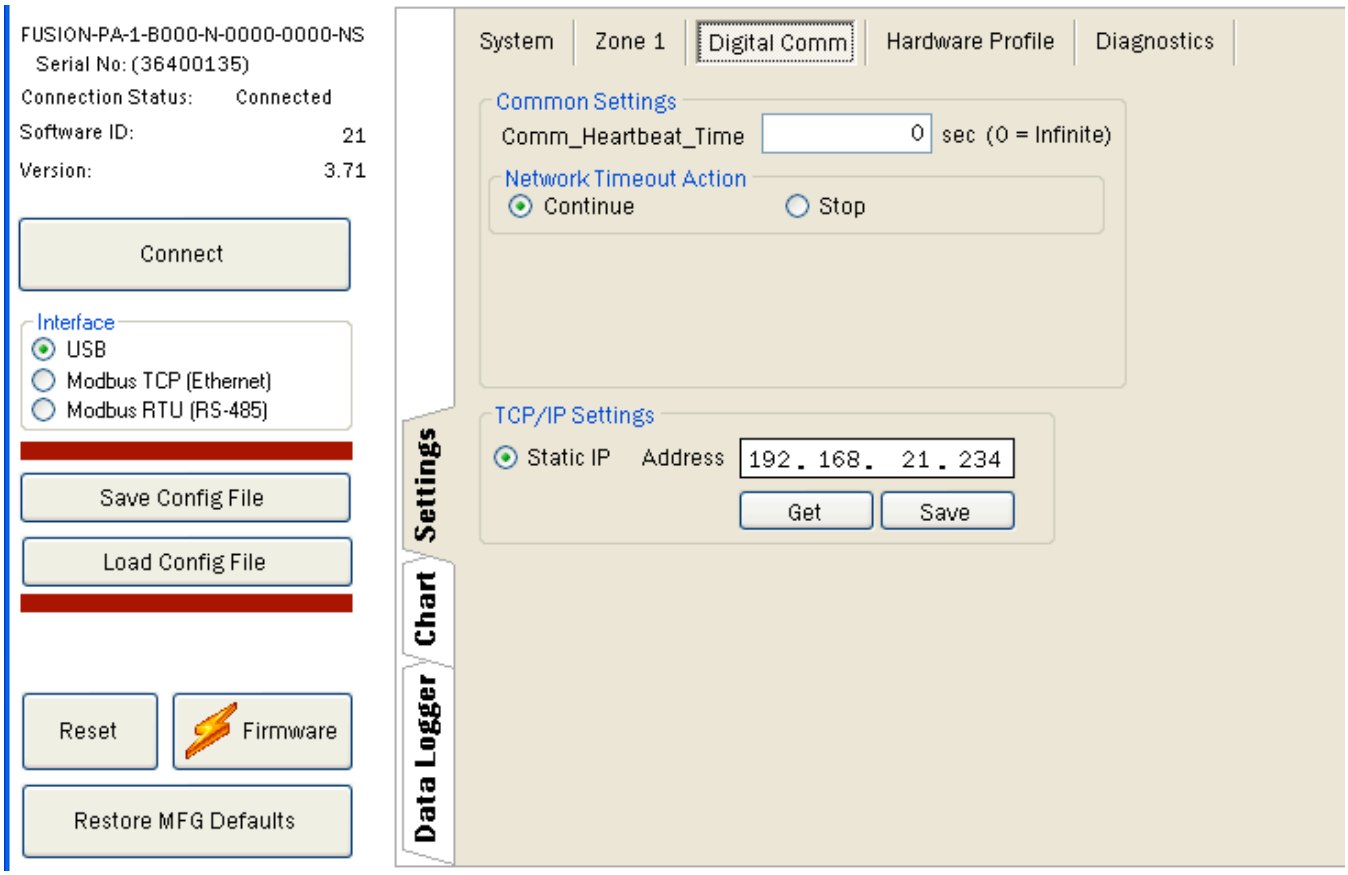
PLC Software: RSLinx Classic Lite

1) Configure Ethernet/IP with RSLinx Classic Lite. Click Communications -> Configure Drivers and set ETHIP and ETH driver to run.



2) In RSLinx Classic click Communications->RSWho. Verify Fusion present in ETHIP with IP address set in Fusion Control Panel using USB communications.

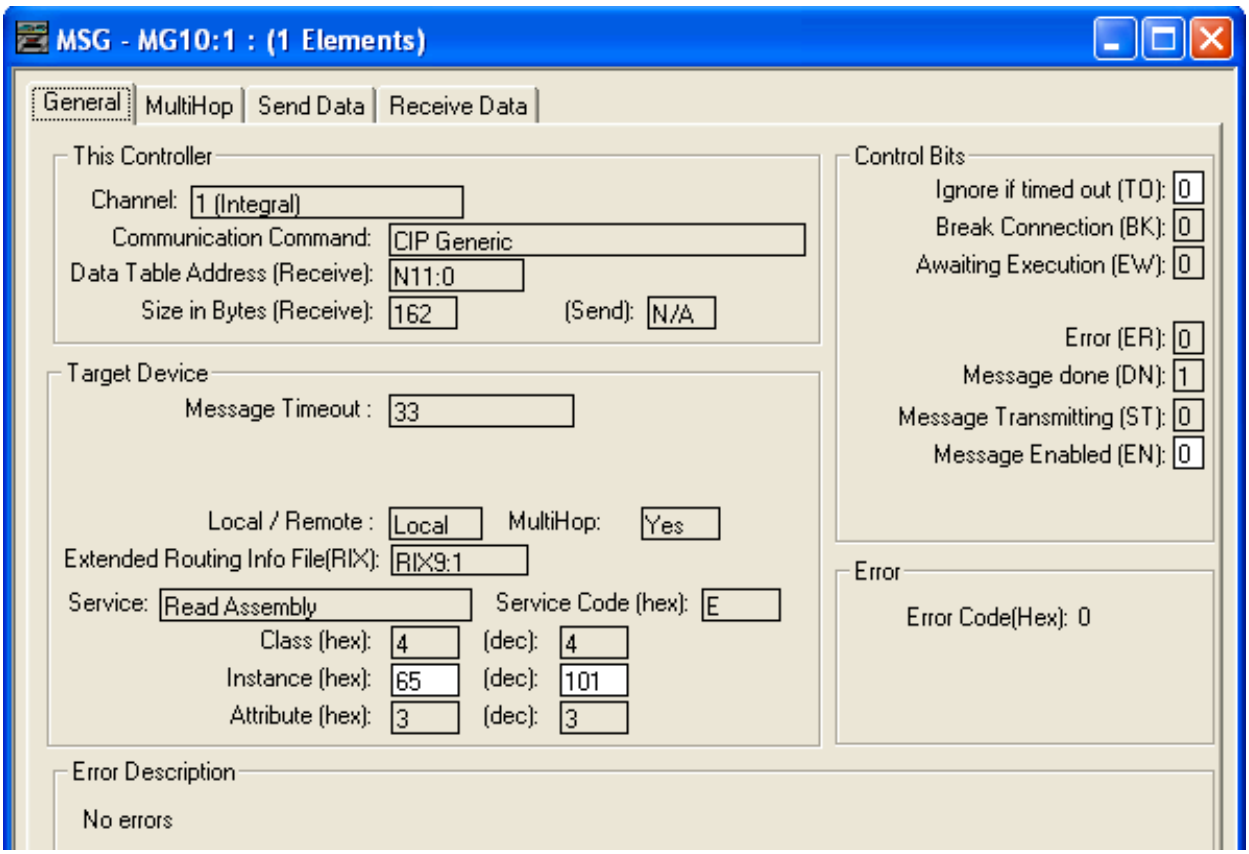


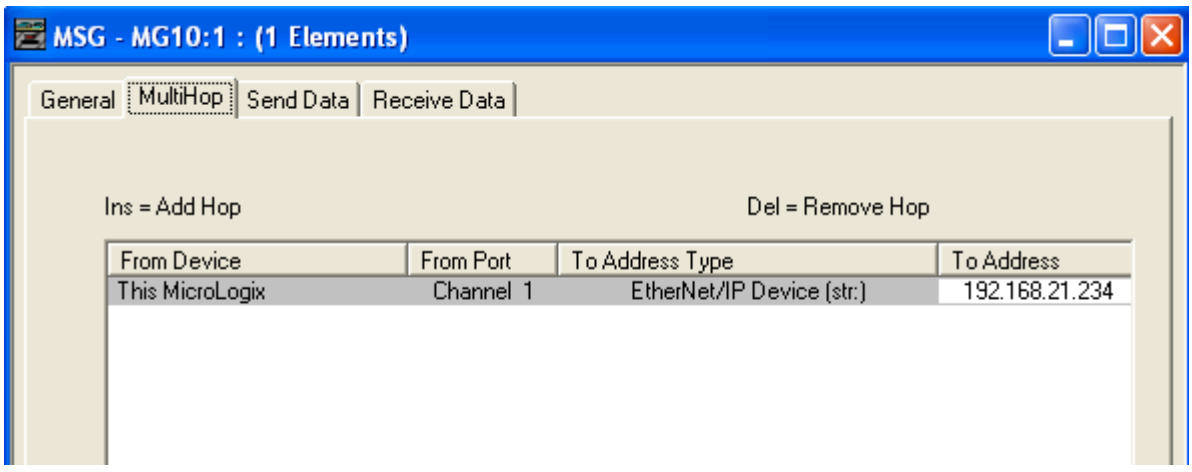

FUSION-PA-1-B000-N-0000-0000-NS
Serial No: (36400135)
Connection Status: Connected
Software ID: 21
Version: 3.71
Connect
Interface
USB
Modbus TCP (Ethernet)
Modbus RTU (RS-485)
Save Config File
Load Config File
Reset
Firmware
Restore MFG Defaults
System
Zone 1
Digital Comm
Hardware Profile
Diagnostics
Common Settings
Comm_Heartbeat_Time
0
sec (0 = Infinite)
Network Timeout Action
Continue
Stop
TCP/IP Settings
Static IP
Address
192 . 168 . 21 . 234
Get
Save
Settings
Chart
Data Logger

5. FUSION Ethernet/IP with MicroLogix 1100 PLC

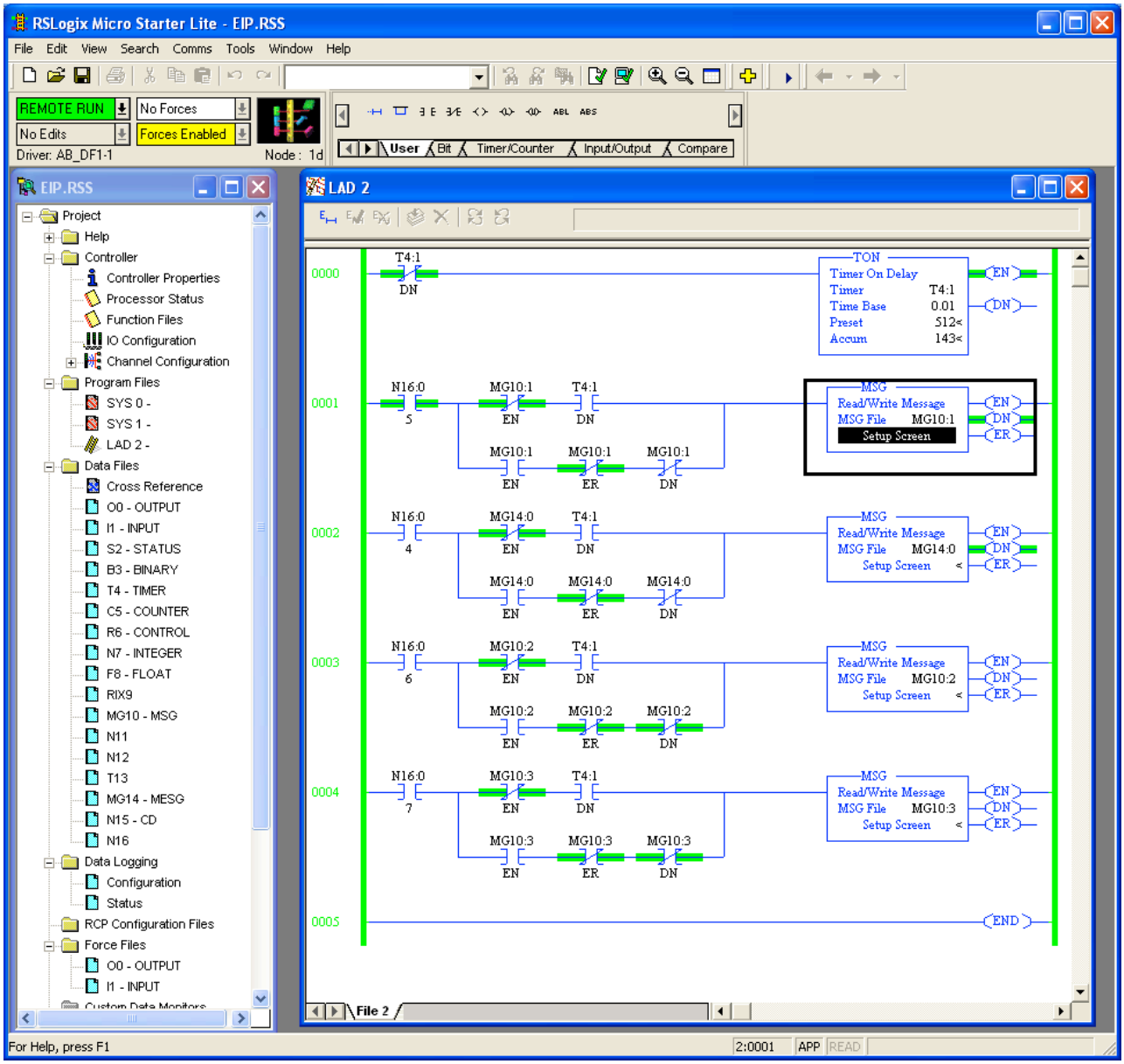
PLC: AB MicroLogix 1100
PLC software: RSLogix Micro Starter Lite

1) Create data buffer and message to read input buffer. The data buffer size will be 162 bytes with the message Class 0x04 (Read Assembly), Instance 0x65, Attribute 0x03. Add the IP address of Fusion unit in MultiHop tab.

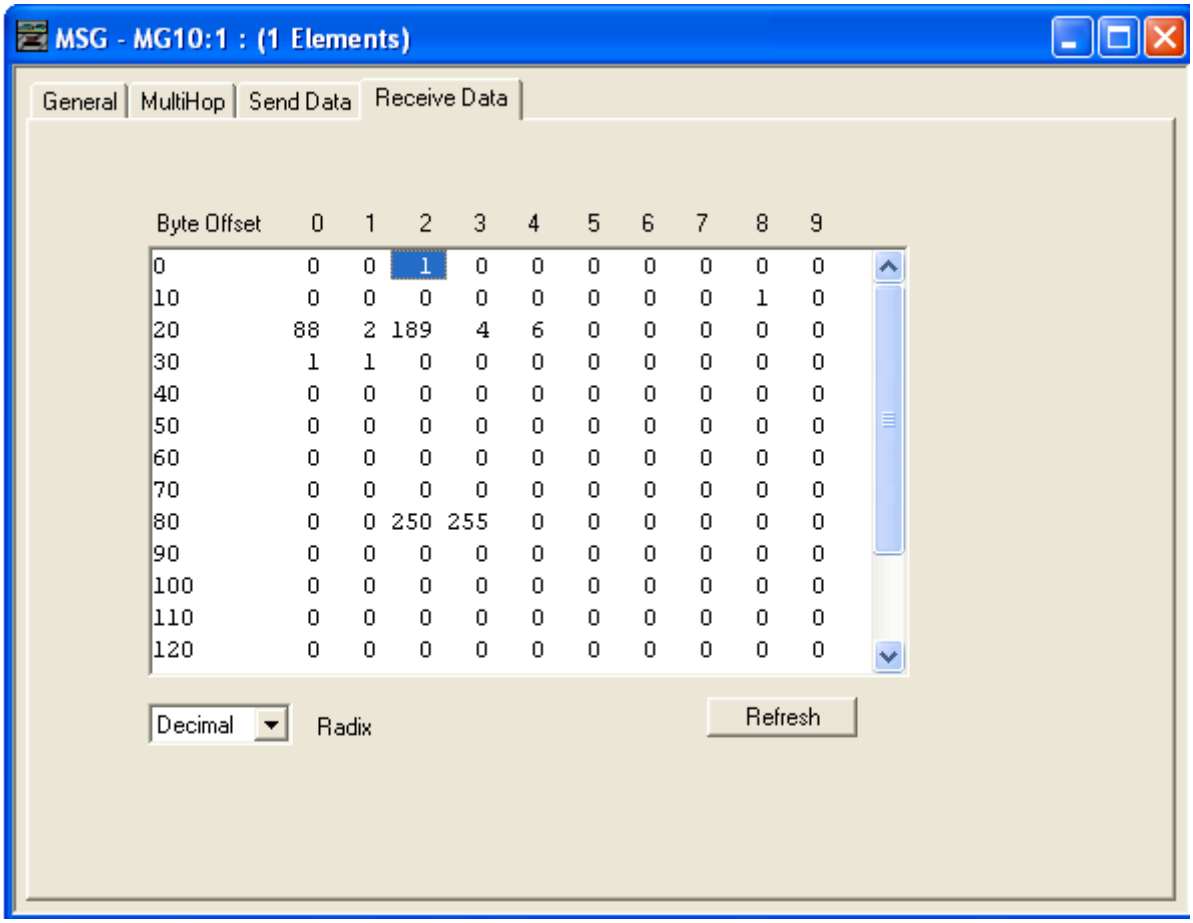




2) Create timer and send message every timer tick. Max sampling rate of Fusion is 5 Hz.



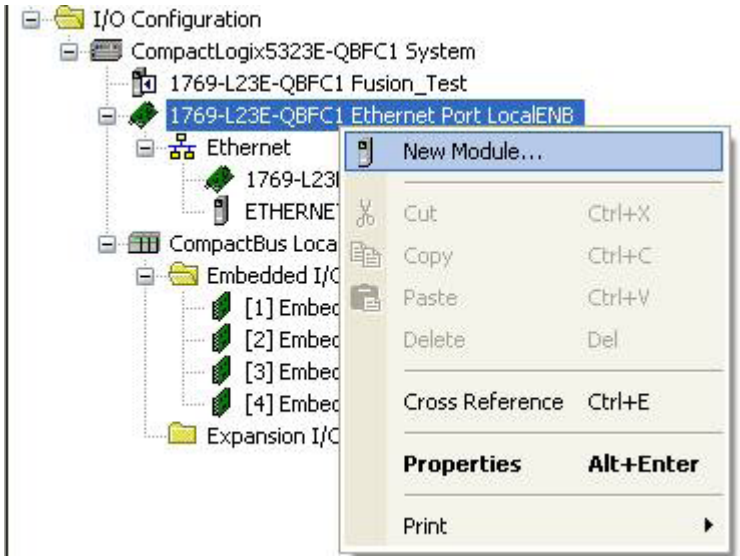
3) Edit the “Dig Setpoint 1” screen to be 0.01. Check that byte 2,3 of the data buffer is 01 00. Ethernet/IP is Little Endian by specification; least significant byte will appear first.



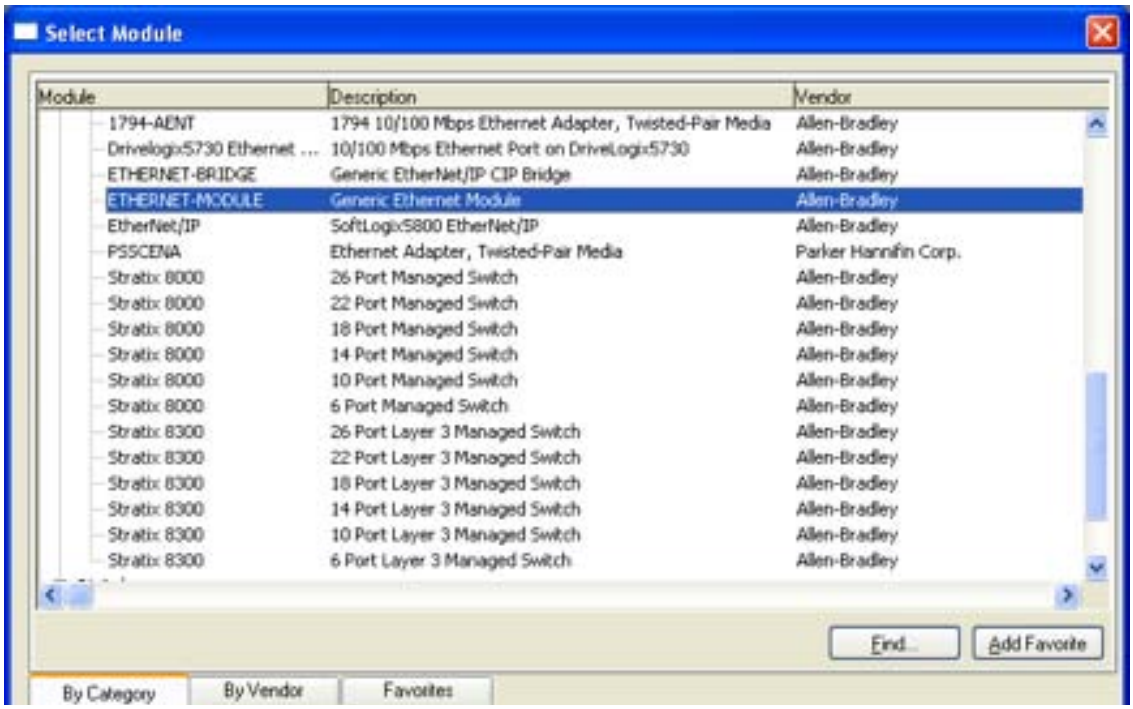
6. FUSION Ethernet/IP with CompactLogix L23E

PLC: CompactLogix L23E-QBFC1B
PLC Software: RSLogix 5000

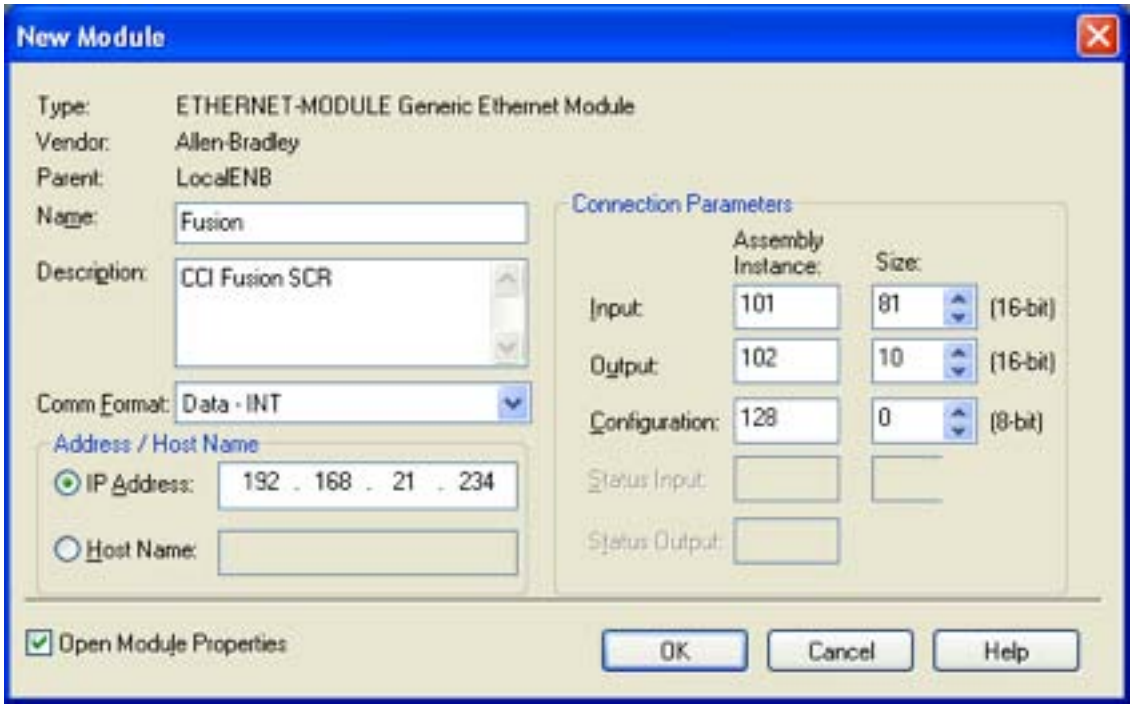
1) Open RSLogix 5000 software. Right click the Ethernet port and select “New module”.



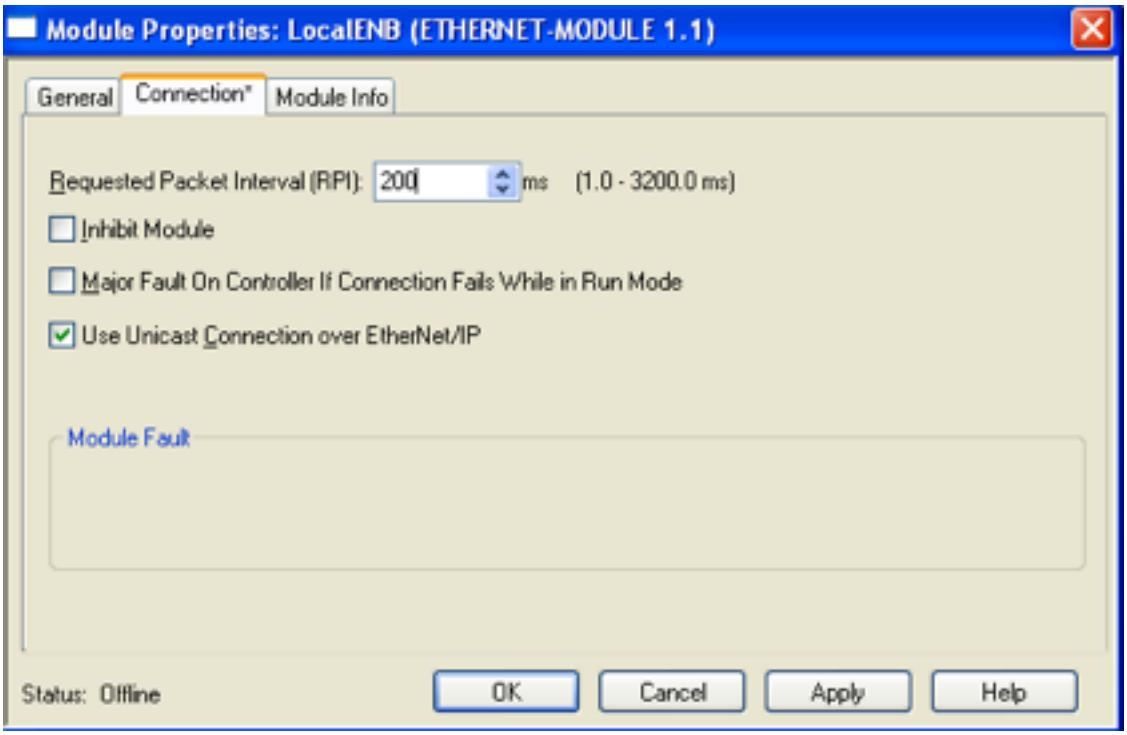
2) Find “Generic Ethernet Module” and click OK.



3) Set the IP address of Fusion with Assembly Instance, size listed below. Click OK.

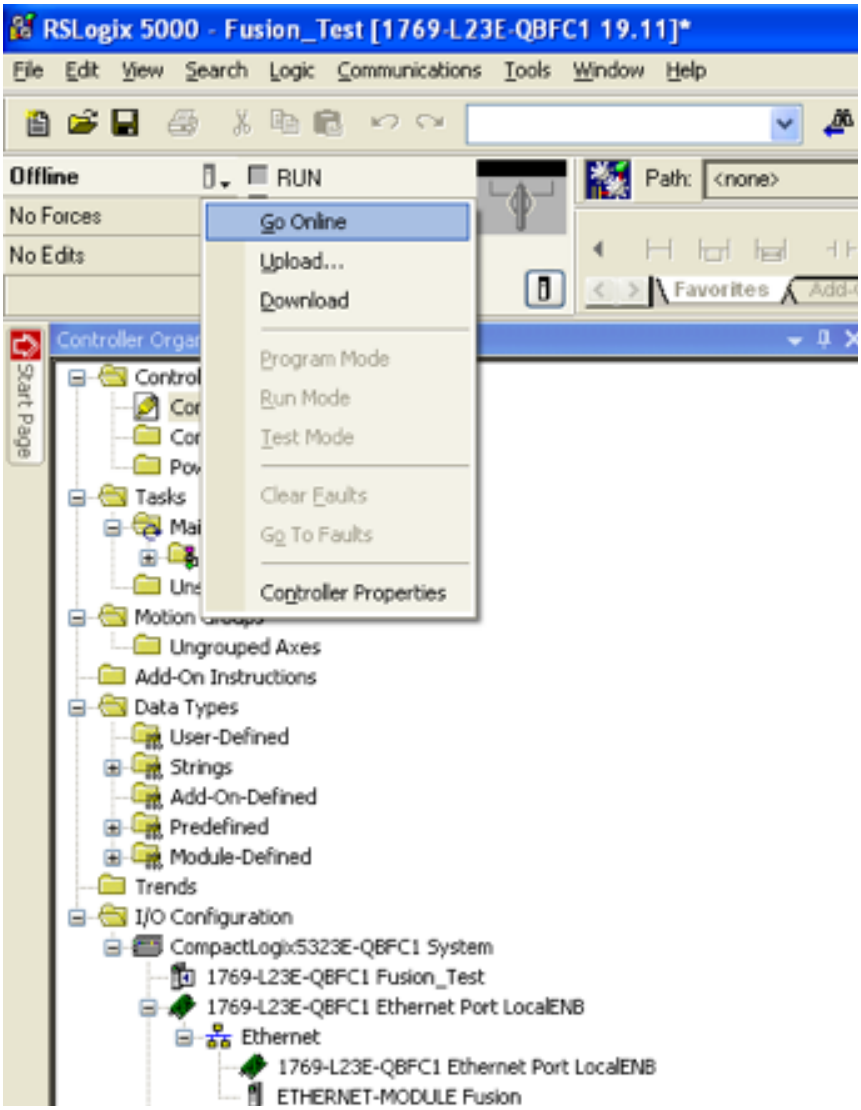


4) Set the Requested Packet Interval (RPI) to 200 ms. Click OK.

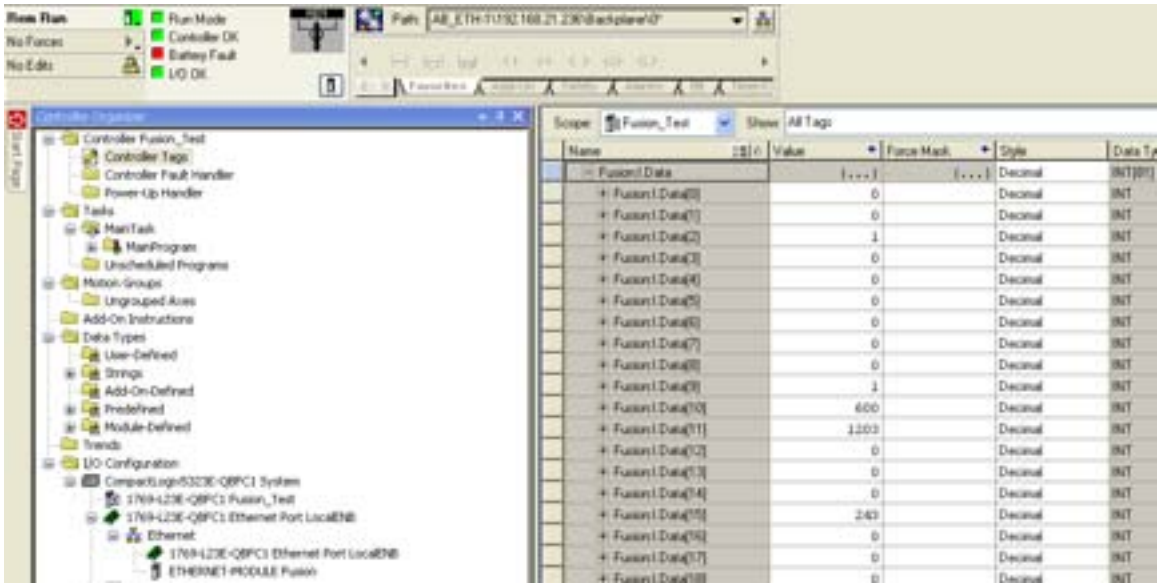


5) The Fusion Ethernet module should appear. If the communication path is ready, set the PLC to Go Online.

Set the communication path in Communication->Who's Active. Download the project and set the PLC to Remote Run.



6) With the PLC set to Run, click the Controller Tags. Check the input data buffer. For the example below line frequency (Integer 10) is 60 Hz (600) and Line Voltage (Integer 11) is 120V (1200).



7) Click the output data buffer in Controller Tags. Set Integer 0 (Output Enable) to 1, Set Integer 1 (Digital Setpoint 1) to 100 (1%), and set Integer 9 (Digital System Command) to 1.

8) Check the input data buffer. Integer 1 (Digital Setpoint 1) should be set to 100 and Integer 9 (Digital System Command) should be set to 1.